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Constructivists Learning Approach to Learners' Motivation and Performance

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Abstract—*This study aimed to determine the relationship between the constructivist learning approach and learners' motivation and performance. It specifically examined the level of constructivist learning approach. Also, the level of learners' motivation and performance in written and practical tests were measured. Furthermore, to find the significant relationship between constructivist learning approach on students motivation and effect on their performance. The study utilized a descriptive-correlational approach to investigate the link between the factors. The respondents were 87 Grade 11 STEM students from two sections at Plaridel Integrated National High School, Nagcarlan, Laguna, during the S.Y. 2024–2025. A researcher-made questionnaire was used to assess the constructivist learning approach and learners' motivation, while a researcher-made assessment measured their performance in mathematics. The findings revealed that the constructivist learning approach was perceived as highly effective, with learners showing very high motivation levels. Additionally, students' performance on the written test was outstanding. In contrast, their performance on the practical test was very satisfactory, indicating strong engagement and proficiency in the subject's theoretical and applied aspects. However, there is a significant relationship between constructivist learning and learners' motivation, and there is significant effect in learners' performance. Based on the findings, the constructivist learning approach significantly relates in learners' motivation leading to rejected of null hypothesis. Therefore, it concluded that the implementation of constructivist strategies alone may be strong predictor of students' motivation. On the other hand, there is significant effect on learners' performance. Thus, this hypothesis is rejected. This means that promoting critical thinking, problem-solving, and teamwork, these strategies enhance students' understanding and mastery of mathematical concepts, leading to improved academic outcomes. The study recommended that Mathematics teachers integrate constructivist strategies to create a more interactive and engaging learning environment. Moreover, students are encouraged to actively participate in these approaches to enhance their understanding and skills. Future researchers may explore using constructivist learning approaches in different mathematical domains to develop more effective instructional strategies.*

Keywords— *Constructivists learning, learners' motivation, and learners performance.*

I. INTRODUCTION

Mathematics is a foundational discipline that helps learners develop logical reasoning and problem-solving abilities. However, many students continue to struggle with mathematical concepts due to their abstract nature and multi-step processes. These challenges are particularly evident in public school settings, where students often perceive math as difficult, leading to reduced interest and engagement. As such, there is a pressing need to adopt teaching strategies that can help students overcome barriers to learning and enhance their academic performance in mathematics (Osakwe et al., 2023).

In recent years, educators have shifted toward student-centered and interactive approaches to foster deeper understanding and retention. The Constructivist Learning Approach has gained prominence for its emphasis on learners actively constructing their own knowledge through experience. Key strategies within this approach include problem-based learning, inquiry-based learning, collaborative learning, and the flipped classroom model. These strategies provide meaningful contexts for learners to explore, question, and connect new knowledge to their prior understanding, thereby promoting long-term retention and conceptual clarity (Mustafa et al., 2021; Van Alten et al., 2019).

The manner in which students interact with and excel in mathematics depends heavily on their motivation. The Constructivist Learning Approach inherently supports various types of motivation including achievement, intrinsic, incentive, and affiliation motivation by creating learning environments that are relevant, collaborative, and goal-oriented. When students are encouraged to take ownership of their learning and see the value in their efforts, their motivation increases, leading to improved academic outcomes (Ryan & Deci, 2020; Sadeghi et al., 2020).

Learners' performance can be assessed through both written and practical tasks, which measure their understanding, problem-solving abilities, and application of knowledge. Constructivist methods provide opportunities for students to demonstrate their learning through authentic assessments, encouraging higher-order thinking and reflection. When instruction aligns with students' interests and fosters meaningful engagement, their performance in mathematical tasks improves significantly (Nzeadibe et al., 2020).

This study investigates the influence of the Constructivist Learning Approach on learners' motivation and performance in mathematics. By integrating strategies that promote active learning, collaboration, and inquiry, this research aims to determine how constructivist practices influence both student engagement and achievement. The study seeks to provide evidence-based recommendations for improving mathematics instruction in public schools, grounded in the understanding that motivated, actively engaged learners are more likely to succeed.

1.1 Statement of the Problem

Problem/s which were addressed by the research

The primary objective of this study is to determine the influence of the Constructivist Learning Approach on learners' motivation and performance in mathematics.

Specifically, it sought to answer the following questions:

1. What is the level of the Constructivist Learning Approach in terms of:
   1.1 Problem-Based Learning;
   1.2 Inquiry-Based Learning;
   1.3 Collaborative Learning; and
   1.4 Flipped Classroom?
2. What is the level of learners' motivation in terms of:
   2.1 Achievement Motivation;
   2.2 Intrinsic Motivation;
   2.3 Incentive Motivation; and
   2.4 Affiliation Motivation?
3. What is the level of learners' performance in terms of:
   3.1 Written Task; and
   3.2 Practical Task?
4. Is there a significant relationship between the Constructivist Learning Approach and learners' motivation in mathematics
5. Does the Constructivist Learning Approach have a significant effect on students' performance in mathematics?

II. METHODOLOGY

The study employed a descriptive-correlational research design to examine the relationship between the variables. The respondents were 87 Grade 11 STEM students from two sections at Plaridel Integrated National High School, Nagcarlan, Laguna, during the S.Y. 2024–2025. A researcher-made questionnaire was used to assess the constructivist learning approach and learners' motivation, while a researcher-made assessment measured their performance in mathematics.

III. RESULTS AND DISCUSSION

This part deals with the presentation, analysis, and interpretation of data that demonstrate the significant relationship between the Constructivist Learning Approach and learners' motivation, as well as its influence on students' performance in mathematics.

Level of Constructivist Learning Approach

This study assessed the level of the Constructivist Learning Approach as applied in mathematics instruction, focusing on four key strategies: Problem-Based Learning, Inquiry-Based Learning, Collaborative Learning, and the Flipped Classroom.

The data were statistically treated using the mean and standard deviation to determine the extent of implementation and effectiveness of each approach.

Table 1 presents the results for Problem-Based Learning, reflecting various indicators with their corresponding mean, standard deviation, and interpretation.

The computed weighted mean of 4.53 with a standard deviation of 0.50 indicates a highly constructed use of Problem-Based Learning in mathematics. This result reveals that the approach is consistently practiced and implies that it effectively enhances students' ability to solve real-life mathematical problems, apply critical thinking, and develop analytical and reasoning skills.

These findings align with Lim (2023), who indicated that Problem-Based Learning fosters self-directed learning and critical thinking by engaging students in meaningful problem-solving tasks.

TABLE 1. Level of the Constructivist Learning Approach in Terms of Problem-Based Learning

STATEMENTS…	MEAN	SD	REMARKS
I am encouraged to solve real-life mathematical problems through this approach.	4.60	0.49	Strongly Agree
The activities challenge me to think critically and find solutions on my own.	4.55	0.50	Strongly Agree
I gain a deeper understanding of mathematical concepts by working on meaningful problems.	4.53	0.50	Strongly Agree
Problem-solving tasks improve my analytical and reasoning skills.	4.52	0.50	Strongly Agree
I feel more engaged in learning when lessons are presented as real-world problems.	4.46	0.52	Strongly Agree
Weighted Mean	4.53		
SD	0.50		
Verbal Interpretation	Highly Constructed		

The high level of engagement in real-world problem scenarios reveals that this method effectively deepens students' mathematical understanding and improves their problem-solving capabilities.

Level of the Constructivist Learning Approach in Terms of Inquiry-Based Learning

Table 2 presents the level of the Constructivist Learning Approach in terms of Inquiry-Based Learning.

The computed weighted mean of 4.86 with a standard deviation of 0.35 indicates a highly constructed level of engagement and effectiveness in learning mathematics through Inquiry-Based Learning (IBL). The consistently high ratings indicate that this approach encourages students to ask questions, actively explore concepts, and engage in meaningful investigations.

TABLE 2. Level of the Constructivist Learning Approach in Terms of Inquiry-Based Learning

STATEMENTS…	MEAN	SD	REMARKS
I am encouraged to ask questions and seek answers independently.	4.94	0.23	Strongly Agree
I actively participate in exploring mathematical concepts through investigations.	4.79	0.41	Strongly Agree
The activities promote curiosity and deeper learning.	4.89	0.32	Strongly Agree
I feel motivated to discover and learn new ideas.	4.86	0.44	Strongly Agree
Inquiry-based tasks help me retain mathematical concepts better.	4.84	0.37	Strongly Agree
Weighted Mean	4.86		
SD	0.35		
Verbal Interpretation	Highly Constructed		

This implies that IBL fosters curiosity, motivation, and deeper learning, as students take an active role in discovering mathematical ideas. The strong engagement in inquiry-based tasks indicates that this approach effectively enhances concept retention and critical thinking skills.

These findings align with Gholam (2024), who revealed that IBL encourages students to take charge of their learning, fostering creativity and deeper understanding of mathematical concepts. Inquiry-based tasks allow students to actively engage in the learning process, leading to better concept retention.

This indicates that IBL is an effective approach in promoting critical thinking and independent problem-solving skills.

Table 3 presents the level of the Constructivist Learning Approach in terms of Collaborative Learning, as reflected with their corresponding mean, standard deviation, and remarks.

TABLE 3. Level of the Constructivist Learning Approach in Terms of Collaborative Learning

STATEMENTS…	MEAN	SD	REMARKS
I enjoy working with my classmates in group activities.	4.83	0.49	Strongly Agree
Discussions with my peers help me understand lessons better.	4.84	0.45	Strongly Agree
I learn new strategies and perspectives from my groupmates.	4.84	0.43	Strongly Agree
Group activities enhance my ability to communicate mathematical ideas.	4.79	0.46	Strongly Agree
Working collaboratively improves my problem-solving skills.	4.79	0.49	Strongly Agree
Weighted Mean	4.82		
SD	0.46		
Verbal Interpretation	Highly Constructed		

The computed weighted mean of 4.82 with a standard deviation of 0.46 indicates a highly constructed level in implementing Collaborative Learning in mathematics. The consistently high ratings reveal that students greatly benefit from group discussions, peer interactions, and teamwork, which enhance their understanding, communication, and problem-solving skills

These findings align with Siller and Ahmad (2024), who indicated that collaborative learning fosters peer support, reduces anxiety, and enhances students' academic engagement. This approach strengthens mathematical comprehension by encouraging the exchange of ideas.

Table 4 presents the level of the Constructivist Learning Approach in terms of Flipped Classroom, as reflected in various statements with their corresponding mean, standard deviation, and remarks. The computed weighted mean of 4.77 with a standard deviation of 0.46 indicates a highly constructed level of effectiveness in implementing the Flipped Classroom approach in mathematics.

The consistently high ratings reveal that students find pre-class preparation beneficial, allowing them to engage more confidently in discussions, manage their learning pace, and apply concepts effectively during in-class activities. This indicates that the flipped classroom method enhances student autonomy, making them more responsible for their learning. Additionally, the approach fosters a deeper understanding of mathematical concepts as students come to class better prepared, leading to more meaningful and interactive discussions.

TABLE 4. Level of the Constructivist Learning Approach in Terms of Flipped Classroom

STATEMENTS…	MEAN	SD	REMARKS
Watching videos or reading materials before class helps me understand lessons better.	4.67	0.56	Strongly Agree
Classroom discussions are more engaging after studying the lesson in advance.	4.57	0.60	Strongly Agree
I feel more confident participating in class after preparing ahead.	4.86	0.35	Strongly Agree
The flipped classroom approach helps me manage my learning pace effectively.	4.87	0.33	Strongly Agree
I can apply what I learned independently through in-class activities.	4.86	0.44	Strongly Agree
Weighted Mean	4.77		
SD	0.46		
Verbal Interpretation	Highly Constructed		

These findings align with Zhang et al. (2024), who indicated that the flipped classroom promotes student-centered learning, enhances engagement, and allows for interactive classroom experiences. The high level of agreement indicates that this approach improves students' comprehension and active participation in mathematical learning.

Level of Learners' Motivation

The level of learners' motivation in terms of achievement motivation, intrinsic motivation, incentive motivation and affiliation motivation was treated statistically using mean and standard deviation.

TABLE 5. Level of Learners' Motivation in Terms of Achievement Motivation

STATEMENTS…	MEAN	SD	REMARKS
I feel motivated to improve my math skills through constructivist learning approaches.	4.87	0.33	Strongly Agree
I set personal goals to perform better in mathematics.	4.72	0.45	Strongly Agree
I feel a sense of accomplishment when I successfully complete math tasks.	4.72	0.50	Strongly Agree
I strive to do my best in math because I enjoy learning it.	4.84	0.37	Strongly Agree
I am eager to learn new math concepts to enhance my skills.	4.80	0.48	Strongly Agree
Weighted Mean	4.79		
SD	0.43		
Verbal Interpretation	Highly Motivated		

Table 5 presents the level of learners' motivation in terms of Achievement Motivation, as reflected in various statements with their corresponding mean, standard deviation, and remarks.

The computed weighted mean of 4.79 with a standard deviation of 0.43 indicates a highly motivated level of achievement motivation among students in mathematics. The consistently high ratings reveal that students are strongly driven to improve their math skills, set personal goals, and experience a sense of accomplishment when they successfully complete mathematical tasks. This indicates that constructivist learning approaches play a significant role in fostering students' enthusiasm and persistence in learning mathematics. Furthermore, the results reveal that students view mathematics as an engaging subject, motivating them to continuously strive for mastery and develop their problem-solving abilities.

These findings align with Singh & Sagar (2023), who emphasized that achievement motivation plays a crucial role in students' success by promoting perseverance and goal-setting, which enhance learning outcomes. The high level of agreement indicates that motivation significantly influences students' engagement and performance in mathematics.

Table 6 presents the level of learners' motivation in terms of Intrinsic Motivation, as reflected in various statements with their corresponding mean, standard deviation, and remarks.

TABLE 6. Level of Learners' Motivation in Terms of Intrinsic Motivation

STATEMENTS…	MEAN	SD	REMARKS
I enjoy solving math problems even without external rewards.	4.84	0.37	Strongly Agree
Learning math gives me a sense of personal satisfaction.	4.53	0.50	Strongly Agree
I feel excited when exploring new mathematical concepts.	4.90	0.31	Strongly Agree
I prefer learning math through interactive and engaging activities.	4.53	0.50	Strongly Agree
I feel confident in my ability to understand and apply math concepts.	4.78	0.44	Strongly Agree
Weighted Mean	4.71		
SD	0.42		
Verbal Interpretation	Highly Motivated		

The computed weighted mean of 4.71 with a standard deviation of 0.42 indicates a highly motivated level of intrinsic motivation among students in mathematics. The consistently high ratings reveal that students find personal satisfaction in learning mathematics, enjoy solving problems without external rewards, and feel excited about exploring new concepts. This indicates that students are internally driven to engage with mathematical learning, which enhances their confidence and deepens their understanding. Additionally, the strong preference for interactive and engaging activities implies that constructivist approaches play a vital role in maintaining students' enthusiasm and curiosity in mathematics.

These findings align with Khan & Younas (2021), who stated that intrinsic motivation is a key factor in academic success, as students who learn for personal fulfillment exhibit higher engagement and better learning outcomes. The high level of agreement suggests that students' intrinsic motivation significantly contributes to their overall confidence and enjoyment in learning mathematics.

Level of Learners' Motivation in Terms of Incentive Motivation

Table 7 presents the level of learners' motivation in terms of Incentive Motivation, as reflected in various statements with their corresponding mean, standard deviation, and remarks.

The computed weighted mean of 4.76 with a standard deviation of 0.44 indicates a highly motivated level of incentive motivation among students in mathematics. The high ratings reveal that students are strongly driven by rewards, recognition, and positive reinforcement. The consistently high scores further indicate that acknowledgment and encouragement significantly enhance students' motivation to excel. These results imply that external incentives play a crucial role in sustaining students' engagement and commitment to learning mathematics.

TABLE 7. Level of Learners' Motivation in Terms of Incentive Motivation

STATEMENTS…	MEAN	SD	REMARKS
I am more motivated when given rewards or recognition for my performance.	4.80	0.40	Strongly Agree
Positive feedback from my teacher encourages me to work harder in math.	4.76	0.43	Strongly Agree
I perform better when my efforts are acknowledged.	4.67	0.56	Strongly Agree
Earning high grades motivates me to study math more.	4.75	0.44	Strongly Agree
I find motivation in competition and friendly challenges in math activities.	4.83	0.38	Strongly Agree
Weighted Mean	4.76		
SD	0.44		
Verbal Interpretation	Highly Motivated		

These findings align with Anwar (2019), who emphasized that activity-based learning, when combined with incentives, enhances student motivation, achievement, and self-confidence.

The high level of agreement indicates that incentive motivation positively influences students' enthusiasm, reinforcing the effectiveness of reward-based strategies in encouraging active participation and improving mathematical performance. Table 8 presents the level of learners' motivation in terms of Affiliation Motivation, as reflected in various statements with their corresponding mean, standard deviation, and remarks.

The computed weighted mean of 4.75 with a standard deviation of 0.45 indicates a highly motivated level of affiliation motivation among students in mathematics. The results reveal that students feel more engaged and motivated when learning collaboratively with their peers. The high level of agreement indicates that group learning enhances their understanding of mathematical concepts and makes the learning process more enjoyable. Additionally, the strong support from classmates fosters a positive learning environment, reinforcing students' motivation to actively participate in math-related activities.

TABLE 8. Level of Learners' Motivation in Terms of Affiliation Motivation

STATEMENTS…	MEAN	SD	REMARKS
I enjoy learning math more when working with my peers.	4.66	0.61	Strongly Agree
I feel encouraged when I receive support from my classmates.	4.80	0.40	Strongly Agree
Collaborating with my peers makes learning math more enjoyable.	4.57	0.56	Strongly Agree
Group learning helps me gain a deeper understanding of math concepts.	4.86	0.35	Strongly Agree
I feel more engaged in class when I work together with my classmates.	4.87	0.33	Strongly Agree
Weighted Mean	4.75		
SD	0.45		
Verbal Interpretation	Highly Motivated		

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These findings align with Cagatan & Quirap (2024), who emphasized that collaborative learning fosters peer support and improves student engagement.

The high level of affiliation motivation among students indicates that social interaction plays a crucial role in maintaining their enthusiasm and commitment to learning mathematics.

Learners' Performance

The level of learners' performance in terms of written test and practical test was treated statistically using the frequency and percentage.

TABLE 9. Level of Learners' Performance in Terms of Written Test

Scores	Frequency	Percentage	Remarks
17-20	64	73.56%	Outstanding
13-16	21	24.14%	Very Satisfactory
9-12	2	2.30%	Satisfactory
5-8	0	0.00%	Fairly Satisfactory
0-4	0	0.00%	Did Not Meet Expectation
Total	87	100%	

Weighted Mean = 18.09
SD=2.20

Table 9 presents the level of learners' performance in terms of the written test. It includes the score ranges, frequency, percentage, and corresponding remarks.

Out of the 87 respondents, the majority (64 students or 73.56%) scored between 17-20, which falls under the Outstanding category. This was followed by 21 students (24.14%) who scored between 13-16, classified as Very Satisfactory. Meanwhile, only 2 students (2.30%) attained scores between 9-12, categorized as Satisfactory. Notably, no students scored within the 5-8 or 0-4 ranges, meaning none were classified under Fairly Satisfactory or Did Not Meet Expectation.

The overall weighted mean score was 18.09, with a standard deviation of 2.20. These results indicate that most students demonstrated an outstanding level of performance in the written test, reflecting a strong understanding of the subject matter and proficiency in problem-solving and mathematical reasoning.

These findings align with Nevid et al. (2022), who emphasized that in-class activities and structured assessments contribute to better academic performance. The high scores attained by most students indicate that engaging learning strategies and effective instructional approaches enhance their mastery of mathematical concepts.

TABLE 10. Level of Learners' Performance in Terms of Practical Test

Scores	Frequency	Percentage	Remarks
17-20	23	26.44%	Outstanding
13-16	31	35.63%	Very Satisfactory
9-12	31	35.63%	Satisfactory
5-8	2	2.30%	Fairly Satisfactory
0-4	0	0.00%	Did Not Meet Expectation
Total	87	100%	

Weighted Mean = 14.18
SD=3.12

Table 10 presents the level of learners' performance in terms of the practical test. It includes the score ranges, frequency, percentage, and corresponding remarks.

Out of the 87 respondents, 23 students (26.44%) scored between 17-20, categorized as Outstanding. The highest percentage of students (31 or 35.63%) scored within the 13-16 and 9-12 ranges, classified as Very Satisfactory and Satisfactory, respectively. Meanwhile, 2 students (2.30%) fell under the Fairly Satisfactory category with scores between 5-8. Notably, no students scored within the 0-4 range, meaning none were classified under Did Not Meet Expectation.

The overall weighted mean score was 14.18, with a standard deviation of 3.12. These results indicate that while most students performed at a satisfactory to very satisfactory level, fewer achieved outstanding scores in the practical test compared to the written test. This reveals that students may require additional support in applying mathematical concepts in hands-on activities to further enhance their practical performance.

These findings align with Obafemi et al. (2023), who stated that practical application and hands-on learning activities enhance students' skill development more effectively than traditional instruction. The results indicate that while students perform well in theoretical assessments, additional reinforcement in applied learning can further improve their proficiency in mathematical tasks.

Test of Significant Relationship Constructivist Learning Approach and Learners' Motivation

To test the Significant Relationship Constructivist Learning Approach and learners' motivation in mathematics in terms of content mastery, resilience, innovation, instructional strategies and classroom management was treated statistically using Jamovi 2.3.28 using the Pearson correlation coefficient.

The correlation coefficients measure the strength and direction of the relationship between the Constructivist Learning Approach and Learners' Motivation in terms of Achievement, Intrinsic Motivation, Incentive, and Affiliation.

A positive correlation indicates that as the implementation of a specific constructivist approach increases, learners' motivation in the corresponding area also tends to increase. Correlations were computed among the four learning approaches using data from 87 students.

TABLE 11. Relationship Constructivist Learning Approach and Learners' Motivation

Constructivist Learning Approach (IV)	Learners' Motivation (DV)			
	A	I	I	A
Problem-Based: Pearson Correlation Significance(2-Tailed) N	 -0.11 0.328 87	 -0.02 0.848 87	 -0.15 0.175 87	 -0.19 0.078 87
Inquiry-Based Learning: Pearson Correlation Significance(2-Tailed) N	 0.02 0.890 87	 0.36*** <.001 87	 0.13 0.237 87	 -0.02 0.889 87
Collaborative Learning: Pearson Correlation Significance(2-Tailed) N	 0.07 0.501 87	 0.17 0.117 87	 0.323** 0.002 87	 0.00 0.955 87
Flipped Classroom: Pearson Correlation Significance(2-Tailed) N	 -0.02 0.868 87	 0.11 0.306 102	 0.04 0.723 87	 -0.02 0.822 87

Note: *p<.05, ** p<.01, ***p<.001

The correlation coefficients ranged from -0.19 to 0.36, indicating very weak negative to weak positive relationships between the Constructivist Learning Approach and Learners' Motivation

Inquiry-Based Learning showed a weak positive correlation with Intrinsic Motivation ($r = 0.36$, $p < .001$), indicating that this approach fosters students' self-driven interest in learning. However, its correlations with other motivation factors were very weak and not statistically significant. Similarly, Collaborative Learning exhibited a weak positive correlation with Incentive Motivation ($r = 0.323$, $p = 0.002$), implying that students engaged in collaborative activities are more motivated by external rewards. On the other hand, Problem-Based Learning and Flipped Classroom approaches showed very weak correlations across all motivation factors, none of which were statistically significant ($p > 0.05$). This indicates that these approaches may not have a strong direct relationship on learners' motivation in this study.

Overall, this implies that the role of Inquiry-Based and Collaborative Learning in enhancing learners' motivation, particularly in promoting self-motivation and incentive-driven engagement. The result indicates that while Problem-Based and Flipped Classroom approaches may provide benefits in other areas of learning, their direct correlates on student motivation remains limited.

These findings align with Gholam (2024), who emphasized that Inquiry-Based Learning encourages students to take ownership of their learning, fostering intrinsic motivation and self-directed engagement. Additionally, Cagatan & Quirap (2024) highlighted that Collaborative Learning enhances student participation by creating a supportive learning environment, reinforcing the connection between teamwork and incentive-driven motivation. The results indicate that while certain constructivist approaches significantly contribute to learners' motivation, others may require additional instructional strategies to strengthen their impact.

Test of Significant Effect of Constructivist Learning Approach on Students' Performance

To test the significant effect of constructivist learning approach on students' performance in mathematics in terms of written test and practical test, was treated statistically using Minitab v.16 using the regression analysis.

Table 12 presents the results of regression analyses examining the effects of different constructivist learning approaches—Problem-Based Learning, Inquiry-Based Learning, Collaborative Learning, and Flipped Classroom—on students' performance in the Written Test and Practical Test.

For the Written Test, the regression model was statistically significant, $F(4, 82) = 4.07$, $p = .005$, accounting for 16.6% of the variance ($R^2 = .166$) in students' performance. Among the predictor variables, Inquiry-Based Learning ($B = 0.97$, $SE = 0.34$, $t = 2.82$, $p = .006$) was the only statistically significant factor ($p < .01$), indicating that students who engaged in inquiry-based learning performed better in written assessments. Meanwhile, Flipped Classroom ($B = 0.49$, $SE = 0.26$, $t = 1.84$, $p = .070$) showed a marginal positive effect, indicating that structured use of flipped learning may contribute to improved written test scores. However, Problem-Based Learning ($B = 0.27$, $SE = 0.25$, $t = 1.07$, $p = .289$) and Collaborative Learning ($B = 0.09$, $SE = 0.26$, $t = 0.35$, $p = .725$) did not significantly impact students' written test performance.

TABLE 12. Summary of Regression Analysis for Students' Performance from Constructivist Learning Approach

	Written Test			
Predictor Variables	B	SE B	t	p
(Constant)	-3.98	2.27	-1.76	0.083
Problem-Based Learning	0.27	0.25	1.07	0.289
Inquiry-Based Learning	0.97	0.34	2.82	0.006**
Collaborative Learning	0.09	0.26	0.35	0.725
Flipped Classroom	0.49	0.26	1.84	0.070
Note. $R^2 = .166$, $F(4, 82) = 4.07$, $p = .005$. *p < .05, **p < .01, ***p < .001.				
	Practical Test			
Predictor Variables	B	SE B	t	p
(Constant)	-3.19	4.00	-0.80	0.428
Problem-Based Learning	-0.06	0.45	-0.13	0.894
Inquiry-Based Learning	1.20	0.61	1.97	0.053
Collaborative Learning	-0.03	0.45	-0.06	0.950
Flipped Classroom	0.34	0.47	0.74	0.464

Note. $R^2 = .060$, $F(4,82) = 1.31$, $p = .274$, *p < .05, **p < .01, ***p < .001.

For the Practical Test, the regression model was not statistically significant, $F(4, 82) = 1.31$, $p = .274$, explaining only 6.0% of the variance ($R^2 = .060$) in students' scores. Among the predictor variables, Inquiry-Based Learning ($B = 1.20$, $SE = 0.61$, $t = 1.97$, $p = .053$) exhibited a marginal positive effect, indicating that students exposed to inquiry-based activities may have improved practical test performance. However, Problem-Based Learning ($B = -0.06$, $SE = 0.45$, $t = -0.13$, $p = .894$), Collaborative Learning ($B = -0.03$, $SE = 0.45$, $t = -0.06$, $p = .950$), and Flipped Classroom ($B = 0.34$, $SE = 0.47$, $t = 0.74$, $p = .464$) did not significantly affect practical test scores.

Overall, this implies that the importance of integrating inquiry-driven learning strategies to improve students' mathematical performance. Educators should consider designing learning activities that encourage students to ask questions, explore concepts, and apply their knowledge to problem-solving scenarios. These findings align with Peramunugamage et al. (2024), who stated that Inquiry-Based Learning enhances students' engagement and promotes deeper conceptual understanding, leading to improved academic performance. Additionally, Zhang et al. (2024) emphasized that the Flipped Classroom model allows students to manage their learning pace effectively, contributing to better comprehension and retention of mathematical concepts. The results indicate that Inquiry-Based Learning plays a crucial role in improving students' mathematical achievement, while other constructivist strategies may require further instructional refinement to optimize their effectiveness.

IV. CONCLUSION AND RECOMMENDATIONS

Based on the findings above, the following conclusions were hereby drawn:

Inquiry-Based and Collaborative Learning have a significant relationship with learners' motivation in mathematics. These approaches foster greater student engagement and interest in the subject by encouraging active participation and collaboration among peers.

Furthermore, Inquiry-Based and Collaborative Learning have a significant positive influence on students' performance in mathematics. By promoting critical thinking, problem-solving, and teamwork, these strategies enhance students' understanding and mastery of mathematical concepts, leading to improved academic outcomes.

In the formulated conclusions from the findings, it was recommended that:

Mathematics teachers may integrate and utilize constructivist learning approaches, such as Inquiry-Based and Collaborative Learning, to create a more engaging and interactive learning environment that enhances student motivation and performance.

Learners may actively participate in these interactive learning strategies to develop a deeper understanding of mathematical concepts and improve their problem-solving skills in a meaningful and enjoyable way.

Future researchers may explore further studies on the effectiveness of constructivist learning approaches in mathematics education to refine and develop more innovative strategies that enhance student engagement and achievement.

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